

HEATED SEAT ASSEMBLY AND METHOD OF MANUFACTURING THE SAME

FIELD OF THE INVENTION

5 The present invention relates to a heated seat assembly used in various transporting means such as aircraft, automobiles, trains and the like, and method of manufacturing the same.

BACKGROUND OF THE INVENTION

10 A conventional heated seat assembly is generally structured like seat assembly 112 provided with planer heater 113, or a heating unit, between surface material 114 and main pad 115 as shown in Fig. 12. One of the methods of manufacturing such seat assembly includes a method of integrally forming surface material and main pad by bonding the planer heater to the surface material 114
15 with use of double-coated adhesive tape followed by foaming and curing of urethane raw material poured into a mold with the surface material 114 provided therein.

 Conventionally, as the planer heater used in such manufacturing method, there is the one type of the planer heater (for example, Japanese Patent No.
20 2621437) that is formed by sewing linear heater to a base material made of cloth such as non-woven fabric and urethane surface cloth as shown in Fig. 13 and Fig. 14. Fig. 13 is an outside view of a conventional seat heater, and Fig. 14 is a schematic view where a linear heater is fixed onto a base material by sewing. In Fig. 13 and 14, linear heater 117 is sewed to base material 118 by upper thread 119
25 and lower thread 120, thereby forming planer heater 116.

 Also, as shown in Fig. 15 and 16, there is a planer heater (for example, Japanese Patent Laid-open Application H8-507404) that is formed by sandwiching a linear heater with two sheets of base material such as non-woven fabric having gas permeability. Fig. 15 is a perspective view of planer heater, and Fig. 16 is a
30 sectional view of the same. In Fig. 15 and 16, planer heater 121 is formed by sandwiching linear heater 122 from both sides by base materials 123, 124 having

through-holes 125. Besides this configuration, it is also possible to bond the linear heater 122 to the surface material 114 by the base material 124 using as an adhesive film.

5 In the case of this planer heater, since the base material is provided with the through-holes 125, urethane raw material flows through the through-holes 125 during a production of the seat assembly, and the surface material 114 directly adheres to the main pad 115, thereby improving the adhesive strength.

10 However, in the conventional method of manufacturing a seat assembly using planer heaters 116, 121, the base materials 118, 123 made of non-woven fabrics or urethane are liable to be impregnated with urethane raw material, and the urethane raw material in the base materials 118, 123 cures without foaming, deteriorating the softness of the seat surface, and as a result, there arises a problem of affecting a seating "feel".

15 Also, in the case of planer heater 121, it is necessary to sandwich the linear heater 122 with the base materials 123, 124, and an adhesive layer is needed for the adhesion of two base materials, causing a number of members and operations for production to be increased, and there arises a problem of complication in production.

20 In the conventional method of manufacturing a heated seat assembly, as shown in Fig. 17, surface material 132 and planer heater 134 are disposed in seat mold 131, and then, urethane raw material 136 is poured in, formed, and cured.

25 However, in the conventional manufacturing method, the planer heater 134 moves and can not be positioned to a predetermined position due to a forming pressure of foam of the main pad 135, and it is unable to obtain a intended temperature of the seat.

Also, as shown in Fig. 18, the planer heater 134 built into the seat assembly is formed into a mat shape by sandwiching linear heater 137 with cloths 138 having through-holes 133, to which impregnation prevention mat 139 for preventing impregnation of urethane raw material and is made of felt or the like is bonded. (For example, Japanese Patent Examined Publication H7-87806).

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In this case, since the surface material 132 and main pad 135 are bonded

to each other via through-holes 133 during foaming, it is desirable to increase an opening area of the through-holes. On the other hand, if the opening area is increased by enlarging the diameter of the through-hole 133, the linear heater 137 become unable to be precisely fixed by the cloths 138, since the linear heater 137 is sandwiched between the cloths 138 having the through-holes 133. Because of such restrictive condition, the opening area of the through-hole 133 cannot be sufficiently increased, and therefore, the adhesive strength between the surface material 132 and main pad 135 is not strong enough, resulting in a problem of worsening of the "feel" due to a de-lamination of the surface material 132.

Further, since the impregnation preventing mat 139 for preventing urethane raw material from impregnating into the cloth 138 is bonded, the planer heater 134 is not bonded to the main pad 135, and there arises a problem that the surface material 134 de-laminates at a portion where the planer heater 134 is disposed, thereby worsening the "feel".

Also, an example of a linear heater used for the planer heater is disclosed in Japanese Patent Laid-open Application 2001-87080. The linear heater disclosed is, as shown in Fig. 19, a linear heater 101 formed by braiding a plurality of conductors 102. In a case of this linear heater, the stresses applied to the linear heater 101, for example, due to a load applied when being seated are dispersed to each of the conductors 102 to improve a bending durability. Also, in the Application, as shown in Fig. 20, conductor 102 and core wire 103 formed of steel wire such as a piano wire or a stainless wire are braided to form linear heater 104, or as shown in Fig. 21, the conductors 102 are braided to form heating element 106 by using tow thread 105 such as aromatic polyamide fibers, polyester fibers, and carbon fibers as a center wire, to improve the tensile strength and bending strength.

However, in the case of the conventional linear heater 104, though, the tensile strength of linear heater can be improved, the bending strength against repeating bending load such as the load applied when being seated is not sufficient. That is, a friction at crossing portions between the core wire 103 formed of steel wire such as piano wire and stainless wire and the conductor 102 causes the conductor 102 to wear and break, and it is unable to sufficiently improve the

durability of the linear heater 104.

Also, in the case of the linear heater 106, generation of such wearing and breaking can be decreased, but it is difficult to produce the linear heater 106 by braiding the conductor 104 so as to have tow thread 107 as the center in a production process.

SUMMARY OF THE INVENTION

The heating element used for the heated seat assembly of the present invention comprises a base material made of a hotmelt material and a linear heater disposed by a predetermined pattern on the base material. The linear heater is bonded or sewed to the base material, and also, in one preferred embodiment of the present invention, the linear heater is formed by braiding a plurality of conductors and threads. Also, in another preferred embodiment of the present invention, a number of threads for forming the linear heater is at least the same with a number of conductors.

According to the heating element of the present invention and the method of manufacturing the heated seat assembly of the present invention, a heated seat assembly which provides excellent seating comfort, or "feel", and an even seat temperatures is obtained, and the durability of the heating element is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a planer heater in Example 1 of the present invention.

Fig. 2 is a sectional view showing a method of manufacturing a heated seat assembly using the planer heater in Example 1 of the present invention.

Fig. 3 is a sectional view of a planer heater in Example 2 of the present invention.

Fig. 4 is a schematic diagram of a heating element with a hotmelt layer attached to a periphery thereof in Example 3 of the present invention.

Fig. 5 is a sectional view showing a method of manufacturing a heated seat assembly in Example 4 of the present invention.

Fig. 6 is a rear view showing a planer heater in Example 4 of the present invention.

Fig. 7 is a sectional view showing a heated seat assembly in Example 5 of the present invention.

5 Fig. 8 is a sectional view showing a heating element according to Example 6 of the present invention.

Fig. 9 is a sectional view showing a heating element according to Example 7 of the present invention.

10 Fig. 10 is an enlarged view of a linear heater according to Example 8 of the present invention.

Fig. 11 is an enlarged view of a linear heater according to Example 2 of the present invention.

Fig. 12 is a perspective view showing a conventional planer heater being mounted in a car seat assembly.

15 Fig. 13 is a schematic view of a conventional planer heater.

Fig. 14 is a sectional view of a heating element fixed portion of the conventional planer heater.

Fig. 15 is a schematic view of another conventional planer heater.

Fig. 16 is a sectional view of another conventional planer heater.

20 Fig. 17 is a schematic view showing a method of manufacturing a conventional heated seat assembly.

Fig. 18 is a sectional view showing another conventional heated seat assembly.

Fig. 19 is an enlarged view of a conventional linear heater.

25 Fig. 20 is an enlarged view of another conventional linear heater.

Fig. 21 is an enlarged view of still another conventional linear heater.

DETAILED DESCRIPTION OF THE INVENTION

30 The Examples of the present invention will be described in the following with reference to the accompanying drawings.
(Example 1)

Fig. 1 is a perspective view of a planer heater (heating element) fixed by a predetermined pattern on a base material made of a hotmelt material. In Fig. 1, planer heater 1 is formed by fixing linear heater 2 using an adhesive 7 in a predetermined pattern on base material 3 made of a hotmelt material.

5 Next, a method of manufacturing a heated seat assembly using the planer heater 1 of the present Example is described with reference to Fig. 2. As shown in Fig. 2, surface material 14 comprises skin layer 14c made of leather, cloth or the like, cover pad 14b made of urethane foam, and cover material 14a made of polyethylene film or woven fabric coated with impregnation prevention material.

10 After the planer heater 1 is fixed on the cover material 14a, the surface material 14 is disposed in lower seat mold 6. And, urethane raw material 8 such as polyol and polyisocyanate to form main pad 15 is poured in the surface material 14, and the urethane raw material 8 is foamed and cured with a upper seat mold (not shown) closed. The urethane raw material 8 has adhesion and adheres to the

15 cover material 14a to be integrated. In the present Example, during foaming and curing of the urethane raw material 8, the base material 3 made of hotmelt material is melted so that the planer heater 1 is bonded to the surface material 14.

According to the above method of manufacturing the heated seat assembly, it is possible to simplify the configuration of the seat assembly while maintaining a softness of the seat. This is because the urethane raw material does not impregnate into the base material, and foamed cells are formed within the entire main pad 15, because the planer heater 1 is bonded to the surface material 14 by melting the base material 3 made of hotmelt material,.

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Also, since the base material 3 plays the roles of both of the base material made of non-woven fabric and the adhesive material such as double-coated adhesive tape conventionally used, the configuration of the planer heater 1 can be made simple.

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As the hotmelt material of the base material 3, materials based on a polyester resin, nylon, polyolefin resin, or polyamide resin is used, but the present invention is not limited to these materials. Also, as a necessary characteristic of the hotmelt material, the melting temperature of base material 3 is desirable to be

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lower than a mold temperature when the seat is molded in order to obtain sufficient adhesive strength of the planer heater 1 to the surface material 14.

If the planer heater 1 is not uniformly bonded to the surface material 14, the urethane raw material may creep into a space between the planer heater and the surface material during the foam forming process, and it may sometimes cause variation in distance between the surface material and the planer heater. In that case, the seat surface temperature varies during heating, deteriorating the seating comfort. In order to prevent this problem, it is necessary to perform uniform bonding of the planer heater 1 and the surface material 14, and the base material 3 is desirable to be previously formed in a shape of the seat assembly.

(Example 2)

Fig. 3 is a sectional view of a planer heater in the second example of the present invention. As shown in Fig. 3, linear heater 2 is fixed on the base material 3 by sewing. As a means to dispose the linear heater 2 on the base material 3, a method of using an adhesive is generally employed. However, in a case of using an adhesive, the hotmelt material of the base material 3 may dissolve by the adhesive, and it may decrease a strength of adjacent portions of the base material 3 where the linear heater 2 is fixed. In such case, bad influences to the hotmelt material caused by the adhesive can be avoided by fixing the linear heater on the base material 3 by sewing. Fig. 3 is a side view showing the linear heater 2 fixed by sewing, where the linear heater 2 is fixed on the base material 3 made of the hotmelt material by using upper thread 4 and lower thread 5.

Also, when at least one of the upper thread 4 and the lower thread 5 used for sewing is made of a hotmelt material it is possible to lessen a protruding of the thread at an upper part of the linear heater on a surface layer when the planer heater 1 is bonded to the surface material 14. Further, since at least one of the upper thread 4 and lower thread 5 melts, a thickness of the planer heater 1 can be reduced at the portion where the linear heater 2 is disposed.

Further, when fibrous hotmelt materials are used as the base material 3, it becomes possible to improve the softness of the planer heater as compared with a

seat-shaped base material, and to lessen the stiffness of the seat when seated. Also, by using the fibrous materials, it is possible to suppress the generation of creases when the linear heater is sewed onto the base material. When the base material 3 has a specific shape such as seat-shaped, shrinking and expanding
5 forces are applied to the base material 3 by the linear heater sewed and the upper thread and lower thread used for sewing, and such forces deform the base material, resulting in considerable creasing. However, when the fibrous base materials are used, if shrinking and expanding forces are applied to the base material by the linear heater and the upper thread and lower thread, the forces partially deform the
10 fibrous base material. In this way, the forces deforming the entire base material 3 are reduced and dispersed, and thereby, it is possible to suppress the deformation of the base material such as creasing.

The base materials made of such fibrous hotmelt materials are available under the trade name of WEB ADHESIVE and SHARNET supplied by BOSTIK
15 in the United States of America but the present invention is not limited to these materials.

(Example 3)

Fig. 4 is a schematic view of a linear heater with hotmelt layer formed on a periphery thereof. In Fig. 4, the linear heater 9 of the present example is
20 configured in that hotmelt layer 11 is formed on an outer periphery of heating element 10. The hotmelt layer 11 melts when the planer heater is heat-bonded to the surface material, then solidifies, and thereby improving the holding strength of the linear heater on the surface material.

25 It is preferable to use a material based on polyester resin, nylon, polyolefin resin, or polyamide resin as a material for the hotmelt layer 11, but the present invention is not limited to these materials.

In the description of the above examples, a method of using an adhesive and a method of sewing are described as the method of fixing the linear heater
30 onto the base material, but the method of fixing the linear heater onto the base material is not limited to these methods.

(Example 4)

Fig. 5 is a schematic view showing a method of manufacturing a heated seat assembly in the fourth example of the present invention. Fig. 6 is a rear view of a heating element built into the seat assembly.

As shown in Fig. 5 and Fig. 6, heating element 27 has a structure where linear heater 25 and temperature regulator 35 are fixed by adhesive 26 on base material 24 having a mesh structure and made of polyester resin. Power supply line 36 is connected to the linear heater 25 and the temperature regulator 35. Also, surface material 22 comprises surface layer 33 made of leather, cloth or the like, cover pad 34 made of urethane foam, and cover material 23 made of polyethylene film or a woven fabric coated with impregnation prevention material or the like. The surface material 22 are formed by bonding, frame laminating or the like method.

Next, the method of manufacturing the heated seat assembly 21 of the present example will be described with reference to Fig. 5. As shown in Fig. 5, firstly, the cover material 23 of the surface material 22 and the heating element 27 are bonded by adhesive 28 to form trim cover 29. And the trim cover 29 is disposed in lower seat mold 30, then urethane raw material 32 to be main pad 31 is poured onto the trim cover 29, and the urethane raw material 32 is foamed and cured while an upper seat mold (not shown) closed. The urethane raw material 32 has adhesive ability and passes through the opening of the base material 24 and places other than the heating element 27 to be bonded and integrated with the cover material 23.

The structure of base material 24 shown in the figure forms a lattice, but the opening of the base material 24 is not limited to the shape of a lattice. For example, the opening may be circular, rhombic, or honey-comb shape, and a shape having a plurality of openings at the crossing portions of mesh (not shown) is also preferable.

In the above description, urethane resin is taken up as an example of resin to be filled as the main pad, but the filling resin is not limited to urethane resin. It

is also possible to use silicone resin, polyethylene, polyvinyl chloride, ethylene vinyl acetate copolymer or acrylic ester copolymer. In the case of using thermoplastic resin, a molding methods such as a foaming injection molding can be employed. When the molten resin viscosity is relatively high, such as foaming
5 injection molding, the advantage of the present invention is greatly enhanced.

Regarding the heated seat assembly manufactured as described above, the advantages will be described in the following.

First, the heating element 27 is fixed on the surface material 22 by using adhesive 28, which is then integrated with the main pad 31. In the present
10 example, the urethane raw material 32 does not creep into the surface material 22 side of the heating element 27, and also, the foaming pressure during foaming of the urethane raw material 32 does not move the heating element 27. As a result, the heating element 27 can be disposed at a predetermined position to obtain even warming temperatures as desired.

15 Since the base material 24 having mesh structure is used as the base material of the heating element 27, the opening area can be increased, and the bonding area between the surface material 22 and main pad 31 becomes increased to increase the bonding strength between the surface material 22 and the main pad 31. Consequently, it is possible to prevent de-lamination of the surface material
20 22 and to improve the "feel" of the heated seat assembly.

Further, by using a hotmelt material which melts at a molding temperature of a foaming of the main pad 31 is used as the material for base material 24, the main pad 31, surface material 22, and base material 24 and linear heater 25 can be firmly fixed. As a result, it is possible to prevent de-lamination of the surface
25 material 22 and to improve the "feel" of the heated seat assembly. Further, the linear heater 25 can be precisely disposed at a predetermined position to obtain the desired seat temperature.

(Example 5)

30 Fig. 7 is a sectional view showing a heated seat assembly in the fifth example of the present invention. In Fig. 5, the point of difference of the present

example from example 4 is that hotmelt layer 37 made of polyamide resin, polyethylene resin or the like is disposed between the heating element 27 and the surface material 22 in order to thermally bond the heating element 27 onto the surface material 22.

5 Regarding the heated seat assembly having the above configuration, the advantages will be described in the following.

 In the present example, the hotmelt layer 37 is disposed between the surface material 22 and the heating element 27, and the surface material 22 and the heating element 27 are heat bonded. By this configuration, the process is
10 simplified and a time required for bonding is shortened as compared with a manufacturing method using adhesive, and also, because of using no solvent, the manufacturing method is excellent from the viewpoint of environmental protection. Also, since an entire surface of the heating element 27 can be uniformly bonded and fixed, the adhesive strength between the surface material 22 and the heating
15 element 27 can be further improved. As a result, the entire heating element 27 can be firmly fixed on the surface material 22, and it is possible to prevent delamination of the surface material 22 and to improve the "feel" as a heated seat assembly.

20 (Example 6)

 Fig. 8 is a sectional view showing a heating element according to the third example of the present invention. In the present example, in place of the heating element in example 4, linear heater 25 is fixed on base material 24 of mesh structure by sewing with upper thread 38 and lower thread 39.

25 Regarding the method of manufacturing a heated seat assembly having the above configuration, the advantages will be described in the following.

 Since the linear heater 25 of heating element 27 and the base material 24 of mesh structure are fixed by sewing with the upper thread 38 and the lower thread 39, the linear heater 25 can be firmly fixed on the base material 24 of mesh
30 structure. Further, in the present example, the urethane raw material for main pad 31 impregnates into the upper thread 38 and lower thread 39 fixing the linear

heater 25 and base material 24, and firmly integrate the main pad 31 and the linear heater 25 via upper thread 38 and lower thread 39. As a result, the linear heater 25 can be precisely disposed at a predetermined position, and it is possible to obtain even seat temperatures.

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(Example 7)

Fig. 9 is a sectional view showing a heating element according to seventh example of the present invention. In Fig. 9, the point of difference from example 6 is that the linear heater 25 has a hotmelt layer 40 as an outer layer which melts at the molding temperature of foaming of main pad 31.

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Regarding the method of manufacturing a heated seat assembly having the above configuration, the advantages will be described in the following.

Since the outer layer of linear heater 25 has the hotmelt layer 40 which melts at the molding temperature in foaming of main pad 31, the main pad 31 and base material 24 can be firmly integrated with the linear heater 25 via the heat-melting layer 40. Accordingly, the linear heater 25 can be firmly disposed at a predetermined position, and it is possible to obtain even seat temperatures as desired.

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20 (Example 8)

Fig. 10 is an enlarged view of linear heater 3 that can be used in each of the above examples of the present invention. The linear heater 3 comprises a plurality of conductors 4 and threads 5 braided.

As shown in Fig 10, since the conductor 4 and thread 5 are braided, it is possible to reduce bending stresses applied to the conductor 4 by a load such as a load applied when a driver or a passenger is seated. Also, the thread 5 serves as a buffer material against the friction between conductors 4, and it is possible to avoid the bending angle of the conductor 4 to be sharp, thus, the bending durability of the linear heater 3 is greatly improved.

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When a heating element of high resistance is required in particular, it is necessary to decrease the number of conductors 4 comprising the linear heater 3.

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A conventional linear heater is formed of only conductors, and therefore, a strength of the linear heater decreases. However, according to the linear heater of the present example that is braided with the conductor 4 and thread 5, even in a case of the linear heater 3 of high resistance, it is possible to easily improve the tensile strength and the bending durability by the thread 5. As the thread 5, it is effective to use tow thread of such as aromatic polyamide fiber, polyester fiber, and carbon fiber, but the thread usable for the present invention is not limited to these fibers.

Also, it is possible to improve the durability of linear heater 3 as well as the water resistance and corrosion resistance by coating the conductor 4 with insulating material. As the insulating material, urethane resin is generally used by coating methods such as electro-deposition or dip-coating, however, it is effective to use a highly lubricant material such as fluoro-carbon resin as the insulating material. When the highly lubricant material is used, the friction between the conductors 4 or between the conductor 4 and the thread 5 can be reduced, and it is possible to suppress the wear of the conductor, thereby improving the durability of the linear heater 3. As for the insulation material, insulating materials which are generally employed can be used, and it is not limited to the material mentioned in the present example.

Also, by using a highly lubricant material for the thread 5 itself, the friction between the conductor 4 and thread 5 can be reduced. As for the method of making the thread 5 lubricant, various methods are available, for example, a method of coating or impregnating the tow thread such as polyester fiber with a highly slippery material such as fluoro-carbon resin, or spinning threads using highly lubricant fiber.

Also, it is necessary to properly use linear heaters different in resistance per unit length, and it should be easy to select an appropriate resistance of the linear heater 3 in the manufacturing process. In the present example, the thread 5 may be colored to indicate the resistance. This making it possible to easily select the resistance of the linear heater 3, and thereby, preventing a wrong use of the linear heater in the manufacturing process. Also, the color indication may be

applied to to the insulating material.

(Example 9)

Fig. 11 is an enlarged view of linear heater 6 wherein a number of threads
5 8 is at least the same with a number of conductors 7 in the configuration of
Example 8. As shown in Fig. 11, according to the configuration of the present
example, the conductors 7 do not cross with each other. As a result, the
conductors 7 do not become worn by rubbing with each other according to the
stress applied to the linear heater 6, a breakdown of conductors 7 can be reduced
10 and the durability of heater 6 improves.

As described above, according to the heated seat assembly of the present
invention an excellent seating comfort, or a excellent "feel", and an even seat
temperatures can be obtained. Also, according to the method of manufacturing of
15 the heated seat assembly of the present invention, an even and comfortable seat
temperatures can be obtained because the heater can be disposed at a
predetermined position. Further, the strength of the linear heater of the present
invention is improved as compared with a conventional heater, and the wear due to
the friction between the conductors is reduced, and the durability of the planer
20 heater is improved.